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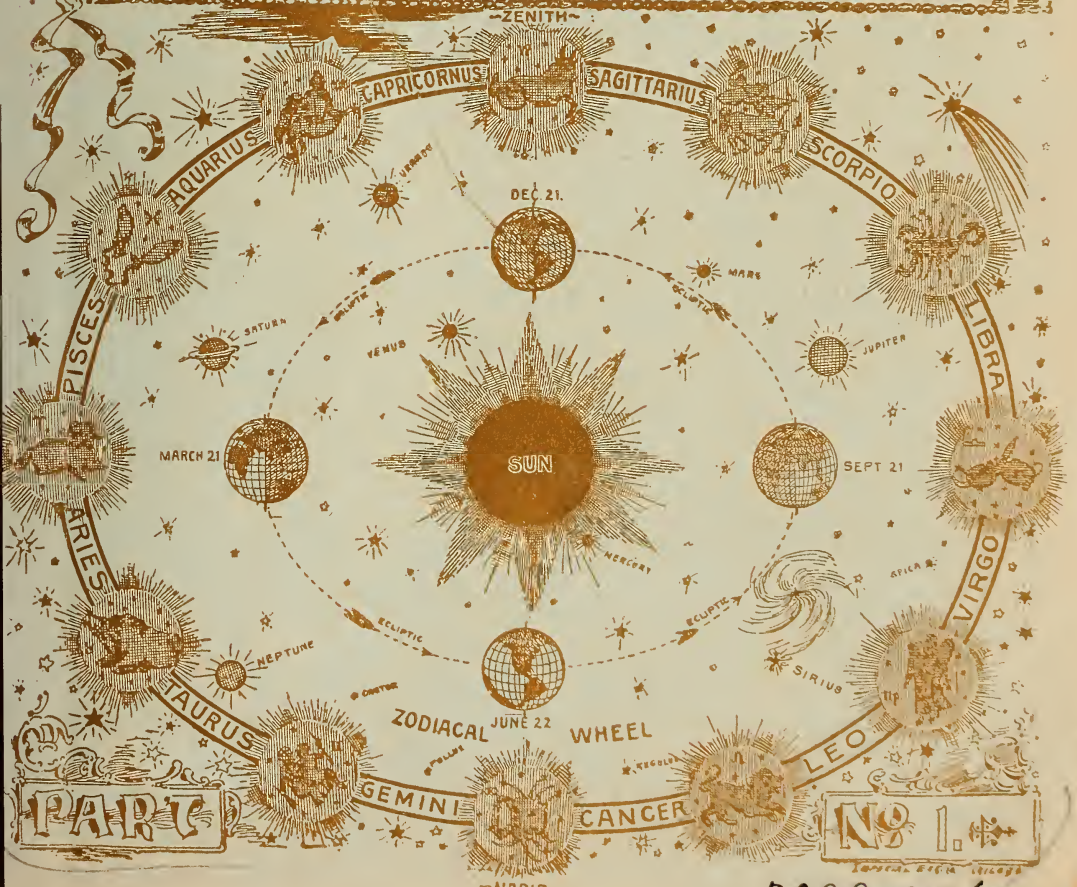
UNITED STATES OF AMERICA.

INFINITE ENERGY

OR THE MYSTERY SOLVED

STORY OF THE STARS



PART No. 1.

3099-aa'

A Thorough and Popular .....

INTROSPECTION

OF THE

Elements of Matter and Attributes of Energy;

AND THEIR

MOTIONS AND PHENOMENA

AS EXPLOITED IN

NATURE'S MARVELOUS FORCES AND WONDERFUL WORKS;
AND AS REVEALED AND EXPLAINED BY THE

MICROSCOPE, SPECTROSCOPE AND TELESCOPE;

AND BY

EXPERIMENTAL RESEARCHES:

EMBRACING MANIFOLD TOPICS IN THE

Curriculum of Science;

AS DESCRIBED IN

Philosophy and Mathematics, Chemistry and Astronomy, Geology and Meteorology, Psychology and Mythology.

INCLUDING

ELECTRO-MAGNETIC PHYSICS,

AND OCCULT SCIENCE.

HIGHLY ILLUSTRATED.

"There are more things in heaven and earth **
Than are dreamt of in our Philosophy."

BY

BENJAMIN FRANKLIN DOWNING,
Member of Chicago Academy of Sciences.

Chicago. New York.

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to Act of Congress, in
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DEDICATORY

TO THE TEACHERS

OF THE

UNITED STATES OF AMERICA,

AS A SOUVENIR OF HIGH ESTEEM,
FOR THEIR ABILITY AND FIRMNESS,
THEIR PATIENCE AND KINDNESS,
AND THEIR REDEEMING EFFORTS;

AND TO MY

CHILDREN AND THEIR MOTHER,

FOR THEIR

Love and Devotion,

THIS WORK OF CAREFUL RESEARCH IS,
WITH PROFOUND CONSIDERATION,
AFFECTIONATELY INSCRIBED

BY

THE AUTHOR.

TO THE READER.

A brief statement of the subjects and a synopsis of scientific queries have been condensed, under the head of Elements, and included in the first twenty pages of part I, so the reader may more readily comprehend the character of the entire work. Each part will be highly illustrated with full page views, to help explain the topics presented. The Zodiacal Wheel, Yerkes' Telescope, the Celestial Atlas and other fine views are worthy of note. Every subscriber to the twenty parts will be entitled to a copy of the Celestial Atlas, gratis.

The work is to be published in twenty parts, size of book 6½x8½ inches, containing 100 pages, printed in blue ink, on double thick No. 1, Super Calender, Cream tint paper. Price $20.00 for full set, $1.00 per copy for each part. Liberal discount to Agents, Authors and Clubs.

Completed numbers, bound in 4 volumes in Cloth, Leather, Turkey or Russia, at lowest prices.

The first number, including illustrations, containing 110 pages, is now ready.

ANNOTATIONS

Honorable mention will be made in each part of authors, publishers and works, freely consulted and noted to verify the views expressed on the topics considered.

Prominent among those referred to are:

NEWTON'S *Principia*, FARADAY'S *Researches*, NOAD'S *Text Book*, TYNDALL'S *Works*, WINCHELL'S *World-Life*, OLMSTED'S *Philosophy*, POP. SCI-MO, MANSFIELD'S *Education*, BURRETT'S *Astronomy and Atlas*, PROCTOR'S *Works*; NEWCOMB, YOUNG, LANGLEY & LOCKYER.

DANA, GEIKE, WELLS AND HITCHCOCK; COOK, DRAPER, COMSTOCK & YOUMANS; FRANKLIN, THOMPSON, WARREN, BROCKLESBY AND MAURY; THE BIBLE, HISTORY OF THE MAGI, MAHAN, HUDSON AND COUS.

These authors and their works, together with many others, are frequently quoted and liberal comments are often made.

ELEMENTS

OF A WORK PUBLISHED IN PARTS,

ENTITLED:

Infinite Energy, or the Mystery Solved

SALUTATORY.

THE NEW AND THE OLD.

It is a remarkable work of investigation.
It is a romance of human knowledge.
It is a story of the mysteries of nature.
It is a startling message for all.
It is plain, practical, sensible science.
It is truthful, useful and beautiful.
It is useful for the general reader.
It is useful for students in the professions.
It is a work for the million

Buy it, read it, study it, and learn the great lesson of Natures Marvelous Forces and Wonderful Works.

NATURAL PROCESSES.

To appreciate the extent and thoroughness of the studies of the subjects mentioned in this work, it is affirmed, that

NATURAL PROCESSES OF COSMIC FORCES EVOLUTE ELEMENTS OF MATTER AND ATTRIBUTES OF ENERGY.

It contains concise statements, lucid arguments and elegant illustrations of manifold topics, including the marvelous results of

RESEARCHES IN ELECTRO-MAGNETIC PHYSICS, AS INTERPRETED BY RATIONAL AND EMPIRICAL PHILOSOPHY, IN THE ANALYSIS OF PHENOMENA.

And the elaboration of these topics, as exhibited in the display of their varied relations to differential phenomena, comprehends the extended field of general science.

The combinations of natural forces result in the

EXPLOITATION OF NATURAL PHENOMENA,

which exhibits the properties of things; their origin, growth, maturity and final destiny. The philosophy of matter and energy, of life in animals and planets, and the

BIRTH, GROWTH AND CONTROL OF WORLDS.

The origin and forms of matter are examined; its composition and distribution in the

ECONOMY OF NATURE;

as observed in the chemical elements, in gases, liquids and solids; and as represented in organic and inorganic bodies;

From Mite to Mammoth, From Atoms to Worlds;

explaining the origin, properties and laws of the subjects presented for investigation.

Thus we learn that the Grandeur and Glories of nature's works are

All worthy of great praise, *All that is Beautiful,*
All that is Grand, *All that is Impressive,*
All that is Magnificent, *All that is Wonderful,*
All that is Inspiring, *All that is Charming,*

IN NATURE'S WIDE DOMAIN,

may be reviewed and contemplated by the aid of suggestions, received while reading this work.

The World's Fair was grand; its views are beautiful.

But in the study of nature— Every sense is satisfied;
Every intellect is feasted; Every sentiment is elevated;
Every thought is exalted; Every life is happier;
Every one attains a grander sphere of life and usefulness.

The work comprehends the enigmatical labyrinths of occult or unseen energies, that are elaborated in

NATURE'S GREAT ARCANUM;

and which are displayed in the various processes that develope phenomena in the visible cosmos.

It describes the properties, numbers and laws

OF ATOMS AND MOLECULES,

of germ life, organized life, from the tiny entity to the myriads of

PLANT AND ANIMAL LIFE,

that swarm in the sea, earth or air, and their various relations to the energy; also,

THE ORIGIN OF DUPLICATE LIFE;

making up the supply and EQUIPMENT OF A WORLD, *for its journey through the skies*, with its moons, meteors, eclipses and tides.

THE MYSTICAL FORMS OF NATURAL FORCES,

are examined and interpreted according to natural law; including differential forms of force; viz.,

MAGNETISM, ELECTRICITY, GRAVITY, GALVANISM, AFFINITY AND PSYCHOLOGY.

These forms of force possess a mystical relation to the origin and production of natural phenomena; and their inherent attributes and their marvelous functions, as exhibited in nature's works, are carefully described and explained. They exert a greater influence in the motion and control of natural processes, in the formation of phenomena, than has, hitherto, been attributed to them.

By certain processes these forms of force, generate differential phenomena, as described in differential environments of matter; viz.,

FORM, SOUND, HEAT, LIGHT AND LIFE.

FORM is again resolved into the ethereal, gaseous, liquid and solid state.

SOUNDS are vibrations producing tones. They are Rhythmic, Melodic and Dynamic; as long or short, high or low, soft or loud, according to the rapidity of the vibrations in a second; the same as light is white or red when the vibrations are fast or slow. Tones are divided into octaves or periods of intervals, as the vibrations increase or diminish in rapidity; and range from the low Diapason of the organ to the high and shrill notes of the Picalo.

The interruption of these rhythmic vibrations creates confusion; and produces noise instead of melody, and discord instead of harmony.

HEAT is latent, apparent, red, incandescent or white like sun's heat.

LIGHT is resolved into seven primary colors; red, orange, yellow, green, blue, indigo and violet; and each color has its number of waves in an inch; and its number of vibrations in a second of time; and *white light* is known as sunlight, electric, magnetic, chemical, incandescent and miraculous light.

LIFE is known in *Typical Forms*, as in animals, plants and spirit forms. The word form is not often used in this sense or in this relation.

But every material and spiritual body, has some kind of typical form and life. It may be inorganic, like the protoplasm, or a wraith, in human form; yet it is alive and possessed of energy.

All matter void of energy dies and disintegrates into

molecules, and is dissipated into space; there it is re-energized, and is again alive and performs its functions.

These are some of the processes continually in operation in the Cosmos.

They are all carefully described and explained in the text of the book.

The topics of intelligence and thought, sensation and motion, and psychic influences might be presented here, but it is not necessary, for other

MYSTICAL FORCES AND PHENOMENA

MUST BE NOTICED; SUCH AS EARTHQUAKES, VOLCANOES, WATER-SPOUTS, CYCLONES, SEISMIC WAVES IN THE EARTH, TIDAL WAVES IN THE SEA AND AIR. AND LUMINOUS EFFECTS; THE IGNIS FATUUS (or Fire of Fate), ST. ELMO'S FIRE, LUMINOUS SEA, DRAGONS AND GLORIES OF LIGHT AND AURORAL GLOW.

The Earth is accompanied through space by

MANY OTHER WORLDS,

like itself in appearance and form. Their numbers, magnitudes, distances, and densities, are counted, measured and weighed according to the laws of modern science. Their times, seasons, and years, are given; and the forces, by which they are moved and controlled in space, are carefully and thoroughly considered.

PSYCHIC FORCES AND PHENOMENA.

Their marvelous relations and processes in the *Human body and its Environments.* The subjects of the Animo

mundi, universal Aura and Astral, the Od or Odylic Force; Miracles and Mysticism, Spiritism and Witchcraft, Ecstacy and Mania and Mesmeric Crises; including Magnetism and Mediumship, Hypnotism and Trance, Clairvoyance and Clairaudience, Sensitiveness and Levitation, Lights and Sounds Magic and Mirage, Telepathy and Teleology.

These with other kindred topics are reviewed, and many new suggestions pertinent to their elucidation are offered.

The views and dicta, of the entire work are plainly and carefully stated, pursuing a candid, independent and popular course with the subjects investigated.

The writer has presumed to introduce some new views and arguments upon *Theses* that have, hitherto, been considered as fixed science.

The work captivates the student by its originality of thought, strength and purity of style, and the free and racy mode of expression. It is full of facts and ideas; and constantly surprises and fascinates the reader as he rushes through its pages.

In thought, one rises in the air, like an angel, flies over earth and sea, gathers a few elements, picks up a few pebbles and builds a world; leaves the earth and soars to the sun; takes in the sweep of the spheres; comprehends a universe of worlds, suns and systems, and discovers the laws by which they are governed; then returns to his study, and records the events of his journey, and thus acquires knowledge.

The work also treats of topics of interest, that are near and around us, as met with in everyday life:

Of physics and mechanics, of the science of life and hygiene, and the story is useful to the general reader, the savant, the student, the mechanic and engineer, in all branches of investigation and industry.

ILLUSTRATIONS.

A fine elevation and complete representation of Yerkes Telescope, presented by him to the University of Chicago, may be found on the cover of the work with a full description in the introductory by Prof. See, of the university.

A mounted Zodiacal wheel, with the twelve constellations, and signs of the Zodiac, is represented on one of the covers of each part. Both these views will be represented in gold on the outside pages.

This giant wheel, also, represents the planisphere of the solar system, with an enlarged view of the earth, in its orbit around the sun; also, showing its position in the four seasons of the year.

The parts descriptive of Astronomical topics will be accompanied by a colored celestial Atlas, size 24x26 inches, representing the constellations of the heavens, in all their grandeur and beauty, highly illustrated by the weird and grotesque forms, of the mythology of the ancients.

An eminent writer says: The adventures of the gods, and inventions of men, the exploits of heroes, and the fancies of poets, are here spread out in the heavens and perpetually *celebrated* before all nations.

Other extensive and appropriate illustrations will be used throughout the work; and described in the text in their proper places; to assist the explanation of the subjects presented. These will include new and important views, in Astronomy, Meteorology, Geology, Chemistry, Electro-Magnetic Physics, and the Occult.

In the general review in each number of the books, many facts and statements are quoted to verify the views presented, supported by a Consensus of current opinions upon scientific topics by eminent authorities, and by short articles of approved correspondents, who may favor us with their views, to elucidate Physical and Metaphysical Science.

While the questions submitted in the synopsis, are investigated and the correct answers sought; yet the writer is cognizant of the fact, that there are mighty problems to be solved. And although confident, that he is following the correct line of thought and investigation, and has arrived at some remarkable conclusions; yet he would be pleased to receive communications on these topics, and they will be published, whether in harmony, or not, with the views expressed in this work.

No one can answer all the interrogatories directly or absolutely; but on the pages of the books they are all carefully considered; and new opinions and propaganda regarding their solution, are eliminated and presented; and new conclusions are sought and found, which may help the reader to solve the queries, and explain the cause of natural phenomena.

This has been the object of the effort of science for ages; in this effort, if we have added a spark to the great light that illumines the temple of knowledge, that enlightens the world, we shall be satisfied.

But we pause here in the midst of our speculations. The very firmament is careering in infinite space, while we ponder on its constitution and history or turn to our material occupations. Our comfortable homes, while we dine or sleep, are rolled through space at the rate of seven hundred miles an hour by the diurnal rotation of the earth. During the same time they are transported sixty-eight thousand miles by the movement of the earth in its orbit. Then the sun, with his entire family of planets, is sweeping through immensity, toward the constellation Hercules, with a velocity which, if equal to that of Arcturus, is two hundred thousand miles an hour. And lastly, there must be some common motion of translation of the whole inextricable maze of moving stars, and with a velocity to which fancy may assign what rate it pleases without restraint from science. This mighty waltz of cosmic dances is joined by the gauzy nebulæ, animated also, like our firmament, by their own internal motions. In the midst of this universe of seething movements is our appointed home. The mind uplifted in the effort to contemplate them and grasp their method, grows giddy and impotent. How sublime these activities! To what a numerous and lofty companionship does our little planet belong? Hard it seems to be imprisoned here while the realm of the universe tempts us to exploration. How can a human soul content itself to roll and whirl through space during its mortal days, and eat and sleep and trifle, like rats in a ship at sea, without wondering where we are and whither we are bound?—*World Life.*

Scientific Queries.

A BRIEF SYNOPSIS OF TOPICS AND QUESTIONS, FREELY DISCUSSED IN THIS WORK; WHICH ALWAYS INTEREST AND EXCITE PUBLIC ATTENTION.

ORIGIN OF WORLDS.

What is star dust, and the dust of time, that buries great cities and old ruins of the earth?
What are Ether Clouds and Firemist?
What are Comets and Nebulæ?
How are worlds made, and how do they grow?
What are their numbers, magnitudes, distances and densities?
Are other worlds like ours?
Are they inhabited by intelligent beings?
How old is the earth, and other planets?
Will the earth come to an end, and how?
Why does the earth whirl on its axis?
And why does it revolve around the sun?
Is the moon a dead world? If so, what killed it?

WHAT IS SPACE?

What is space, and what is in it?
Is space cold or hot, light or dark?

Is there an interstellar medium?
If so, what is its nature and office?

WHAT ARE METEORS?

What are Meteors, and where do they come from?
How many fall upon the earth every year?
Where do Diamonds and Precious Metals come from?
Where does all Matter or Substance come from?

ORIGIN OF MATTER.

What is the original, and first form of matter?
What is the origin of the Gases, *Air*, *Earth and Sea?*
What is the Atmosphere, and where does it come from?
What is Water, and where does it come from?
We say Air is formed of Oxygen and Nitrogen; Water of Oxygen and Hydrogen—all gases.
What is the signification of these terms?
Why do Winds blow and Clouds fly?
What is a Cyclone, and what is its cause?

EVAPORATION.

What pulls up 2,000 million tons of water, into the air from the Mediterranean Sea, every twenty-four hours?
Will Water burn, and why?
Will Metals swim in water, and why?
What pulls up the Water-Spout, with its thousands of tons of water?

PRECIPITATION.

What is the Rain-fall upon the earth in one year; when

one inch in depth, covering one acre of surface, equals 100 tons?

The depth varies from 25 to 100 inches, in various localities, each year. How many tons to the acre? How many acres to the square mile, Township, County, State, United States, the World?

Not a difficult problem, but vast in its conclusions.

DAY AND NIGHT.

What is the cause of Day and Night, change of Seasons, Eclipses and Tides?

ATOMS AND MOLECULES.

What are Atoms and Molecules?

How many in a Cubic inch?

What is it that pushes them apart when air, the gases and steam are expanded?

Why is air expanded in space, with a temperature 100 below zero, Faht.?

NATURAL FORCES.

What are Magnetism, Electricity and Gravity?

What is a Magneto-Electric Dynamo?

Why does Electricity give light?

What is the cause of Thunder and Lightning?

What are Typical Forms, Sound, Heat, Light and Life?

HEAT AND LIGHT OF SUN.

Is the Sun a hot and burning body?

What is the cause of its light and heat?

Does the sun radiate light and heat direct to the earth and other planets?

Does the sun propagate light, heat and energy inversely, as the square of the distances?

Why do stars shine, that are twenty million million miles away?

HOW DO WE KNOW?

How can the scientist tell the distance of these great worlds from us?

How does he know the times and motions of the Planets and Comets, and even the fixed stars, at the very day, hour and minute?

How did Liverrier discover the planet Neptune?

How does the Scientist know the minute that an Eclipse, Transit or Occultation may occur?

He knows the minute the sun, moon and stars will rise or set, or arrive on the Meridian.

THE HUMAN BODY.

"*What a piece of work is man.*"

What is the mystery of the Human Body?

Why does man breathe and his heart beat?

What is the Soul, and Astral Body?

What is the meaning of the Sixth sense?

What is the mystery of Primary and Duplicate Life?

What are Ghosts, Wraiths and Apparitions?

What did the Witch of Endor do when she brought up Samuel?

When Moses saw the burning bush, did the bush burn ? and why ?

IS MAN A MAGNET ?

What are Hypnotism and Trance ?

What are Mesmeric crises ?

If pieces of Silver and Zinc, are placed above and below the tongue, by closing the eyes and mouth, a spark is noticed, and why ?

If a Lady and Gentleman, after chafing their bare feet on a woolen carpet, bring their gold rings together, a spark will pass, why? Some Gentlemen, chafing their hands, can light the gas with their finger tips, and why ?

What is the cause of Sensation and Motion ?

What is the meaning of the law of suggestion ?

WHAT ARE VIBRATIONS ?

What are Light Vibrations ?

What are Heat and Sound Vibrations ?

What are Brain and Nerve Vibrations ?

WHY DOES THE ETHER VIBRATE ?

EPILOGUE.

The object of the writer is to instruct and entertain, to awaken an interest and inquiry into the phenomena of nature, to account for their origin and properties, to discover the laws by which they are governed, and to inspire a desire and discernment for the further prosecution of a most fascinating and useful study.

To a certain extent, the course pursued is novel and presents a line of thought hitherto undeveloped. But, after many years of study and research, the writer is fully pursuaded, that the views presented not only demand attention, but are worthy of the highest consideration by eminent scientific authorities.

In the elaboration of the manifestations of the energy and the productions of phenomena which accompany its activity, we are compelled to look to a *Universal Cause*, as the origin of both. When the attributes and properties of the energy are studied, it appears to be abundantly competent to originate and execute the forces, and produce the phenomena found everywhere in nature.

Much might be said, in a preliminary way, about the energy and the resultant phenomena, but it may be more desirable to surprise the reader as the topics are unfolded to him, from page to page, through the work.

But let us explain: It is said we have chosen a bold title—

INFINITE ENERGY, OR THE MYSTERY SOLVED.

We admit the fact. We believe in it and we are ready to stand by it. We believe in positive philosophy, and use positive terms to support it. It is no catch phrase, and it expresses exactly what we mean.

We state facts, and evolve processes and laws of energy which, if practically and logically considered, will aid in solving the great problems of science. We make these statements with an honest conviction, matured by extensive research, that what we say is true.

We expect to put the foot down firmly—as President Lincoln once said, with whom the writer was intimately acquainted—and keep it there until the field is won.

Science to-day has catalogued many valuable facts, has revealed many valuable truths, and has arrived at many valuable conclusions.

Many other facts and truths are waiting to be recognized as worthy of classification.

Few savants, however, are ready to recognize new relations, or new formulas, of natural law; neither are they ready to accept new conclusions, even when amply verified.

It is easier to run in the old rut, though it requires more time and more theories to rationalize the hypotheses accepted than to investigate new facts to establish correct doctrines.

After a few introductory topics are presented, which will interest the reader, and before discussing the elements and attributes of the energy and other topics, in detail, the writer will present a general view, of a descriptive character, of some of the more important phenomena of nature, so the reader may obtain a more comprehensive idea of the scope and character of the whole work.

These preliminary topics will occupy two or three numbers of the first parts of the work.

Then the energy will be taken up and fully and thoroughly elaborated and explained, and then applied to general phenomena, showing their origin, properties and laws that govern them, and their distribution in the cosmos.

A few of the leading topics first presented are those usually classed under Astro—Physics or Astronomy, including Space and what is in it, as Ether Clouds, Firemist, Starry Matter, and more condensed Nebulæ, also Cosmic Dust and Meteoric Streams, Cometary Masses and Worlds, Suns, Systems, Constellations and the Earth with its phenomena.

From these elevated views we may elaborate the Energy, and discuss its origin, motions, laws, and general phenomena, explaining how worlds are made. Then, with the Energy, we may come to the infinitessimal Molecule and other forms of Matter and Energy.

The writer has presumed to introduce and discuss some new views and arguments upon *Theses hitherto considered as fixed science.*

He is in full sympathy with the views expressed, and cannot, conscientiously, accept the present beliefs on various topics. The examination of light, heat, and energy of the sun leads to new and important conclusions.

It is proved that, for several incontrovertible reasons, neither *the light, heat, nor energy of the sun or planets are radiated into space as a cosmic law of supply.*

The sun and the planets are all bombarded with meteorites and meteoric matter, but not to supply them with fuel to heat and light a universe eternally cold and dark, for space has both these conditions. The origin and laws of cosmical energy are explained in a manner hitherto unrecognized by science.

And the same fact is true of cosmic bodies or worlds, and also of the topics of expansion and evaporation, superheated steam and bodies subject to extreme heat or cold.

The evolution of thought, as outlined here, has taken a new direction, by selecting and utilizing old and new facts, identifying and unifying their results, generalizing and formulating new propositions and codifying them into conclusions and systems, formidable innovations are presented to what has hitherto been considered as fixed science.

Nearly all the facts stated and used in these premises are well known to scientists as true, but the arguments used, and the combinations and conclusions formed, are new and astounding. And the manner the subjects are handled in this work will prove our position correct.

The elaboration of the subject is somewhat extended, but it will amply recompense the reader or investigator for his labor, to study and comprehend the subjects as here presented.

The effort is no vague speculation of an imaginary mind, but every view presented is supported by facts that form a firm scientific basis. The premises are brief and simple, the arguments are new and logical, and the conclusions are certain and inevitable.

The writer is well advised of the embarrassments that may arise from the attempt to controvert current opinion, long accepted upon topics that have the sanction of the ablest writers in the land. But if truth is worth the effort of finding out, it is, also, worth promulgating to the world, and that is the object of this work.

The functions of natural forces are fully elaborated, and their properties and principles are carefully described and explained, and their usefulness is indicated. *The practical utility of these forces receives*

PARTICULAR ATTENTION.

And the *causal conditions* of *form*, *sound*, *heat*, *light*, *life*, *intelligence* and *thought* are reviewed, and their *cause is discovered and explained.*

Other important phenomena are discussed with lucid and trenchant argument. And finally, manifold topics, contained in the curriculum of science, are presented and examined, comparing and unifying their various phenomena

in a more extended and detailed manner, and accounting for them by the laws of the energy.

The topics are described in *Philosophy* and *Mathematics*, *Chemistry* and *Astronomy*, *Geology* and *Meteorology*, *Psychology* and *Mythology*.

CONSTELLATIONS.

In the sweep of the ages, through the cycles of time, man seeks a page or sign on which to write the passing events of the world's history. A single emblem or hieroglyphic may indicate a record, or symbolize notable events, and the interpretation of a stony tablet may tell the tales of the rise and fall of nations, and indicate their civil, political and religious history for centuries.

In earlier times men were romantic and portrayed great events in heroic characters. Natural forces and empirical customs were symbolized by the genius of the age in monsters and heroic forms of creatures and things that, naturally, might represent those forces and customs, and which were often executed in an exaggerated and fantastic design. Art and architecture were redolent of imaginary creations, that often went wide of nature and truth, which afford the only safe types for correct representation.

No conception or design was too intricate or too grand for their effort. Hence we have as examples of their ingenuity such creations as the Tower of Babel, the pyramids of Egypt, the obelisks of the plain, and the exaggerated designs of the sphinxes, tombs and temples of Luxor and Thebes.

They were not satisfied with earthly fields and efforts, but turned their attention to the shining parchment of the skies, and there painted their grotesque figures on the tablets of the stars to represent the clusters and constellations of the heavens.

To locate and describe the stars, they are clustered and grouped together into constellations, represented by forms and figures, and maped out as a geography of the heavens.

Of these constellations there are ninety-three in all, forty-eight old ones and forty-five new ones. And of these thirty-four are Northern, twelve Zodiacal, and forty-seven Southern. Many of these constellations are represented by peculiar and uncouth figures, which indicate an epoch of time, very ancient in the world's history and an era of cabalistic intelligence, when myth and mystery prevailed in the minds of the best writers and scholars.

A writer says: "These constellations are a faithful picture of the ruder stages of civilization.

They ascend to times of which no other record exists, and are destined to remain when all others are lost. Fragments of history, various dates and documents, relating to chronology, geography and language are here preserved in imperishable characters, delineated upon the blue and spangled scroll of the skies."

In the list of illustrations in the first part, may be found a double-page plate, supposed to represent solar systems of the universe.

Our system is represented with the sun, planets and satellites. But other suns have no planets or moons represented, for they are so far away, they cannot be seen by instruments of the highest power.

Comets are also represented as approaching from far distant space, and, suddenly, changing their course toward the central suns.

All the systems appear to be swinging around one grand cosmical center or sun, thus forming the system of the universe. The Zodiacal wheel is on the the first outside page of the work. It is a wheel of enormous size and contains twelve great groups or constellations of stars, which represent the signs of the Zodiac, and also correspond to the twelve months of the year.

Based upon careful calculations the breadth of the starry tire of this wheel cannot be less than thirty million miles, its diameter may represent hundreds of billions of miles, and its circumference is more than three times its diameter.

The Zodiac is a zone or girdle of stars, sixteen degrees in breadth, extending quite around the heavens, and includes all the stars and planets within eight degrees on either side of the ecliptic, which is the plane of the earth's orbit, produced to the Zodiacal Belt, and represents the apparent path of the sun through the heavens.

All the planets revolve around the sun within the breadth of the starry tire of this great Zodiacal wheel. It has twelve constellations, each represented by a sign of

thirty degrees, making 360 degrees measured on the great circle of the ecliptic. The names of these signs are: Aries, the Ram, Taurus, the Bull, Gemini, the Twins, Cancer, the Crab, Leo, the Lion, Virgo, the Virgin, Libra, the Balance, Scorpio, the Scorpion, Sagitarius, the Archer, Capricornus, the Goat, Aquarius, the Water Bearer, Pices, the Fishes.

These signs correspond to the twelve months of the year, beginning with Aries, which represents *March*; Taurus, *April;* Gemini, *May;* Cancer, *June;* Leo, *July;* Virgo, *August;* Libra, *September;* Scorpio, *October;* Sagitarius, *November;* Capricornus, *December;* Aquarius, *January;* Pices, *February*, as they are marked on the maps.

Owing to the precession of the equinoxes these signs change to different months of the year.

Hipparchus informs us that twenty-three centuries ago the constellation Aries occupied the *first sign* in the ecliptic, commencing at the vernal equinox. But as the earth falls back 50 seconds on the equinox every revolution around the sun, the constellations have advanced in the ecliptic about 31° beyond the first sign. The Fishes now occupy the same place in the Zodiac that Aries did in the time of Hipparchus, and Aries is now in the sign Taurus, and all are advanced one sign.

As shown, the earth falls behinds 50 seconds every year as it revolves around the sun. At this rate of recession, the earth would pass through one sign of

30° in 2,160 years. There are twelve signs, 12×2,160=25,920 years for one revolution of the Zodiac. Every one of the twelve signs then will pass through the vernal equinox in the time of one revolution.

Discoveries of Zodiacs in the ancient toombs of Egypt indicate a very remote period, for the sign Leo was represented in the vernal equinox. The sign Pices is in the vernal equinox now, and Leo is five signs ahead of Pices—2,160 years for one sign, five signs equal 10,800 years, since the Zodiac was placed in the Egyptian toombs.

It appears the Zodiac was used by the ancient Egyptians to indicate the time of the ruling dynasties. Thus the scholar by the aid of this science is prepared to estimate the magnitudes, distances and characters of the stars and interpret the legends, written on the tablets of ancient nations.

And thus the heroic figures painted upon the signs of this giant wheel exploit the character, learning and history of the nations and people of the earth at the time they were made. And as this mighty wheel makes one grand revolution in 25,920 years, and as one sign after another is brought to view and displays its records, the astronomer is prepared to read its history and interpret its times, seasons and years, and determine the chronology of the events observed.

II.

LIGHT OF THE AGES.

As one searches for the origin of power or energy in the domain of nature, however liberal and thorough the investigation may be in the various departments of physical and metaphysical philosophy, as hitherto accepted; still the glamour of uncertainty and the hypotheses of mystical speculations, are invariably presented to the mind.

Neither the history of the ancient magi, who held the key to the wisdom of the ages, nor the religious legends and lore of the ancient cabalistic records, nor the savants, who have searched through the curriculum of science for the reason why, nor the psychic sages, who have consulted the horoscope of time, to predict the destinies of nations, neither prophet, priest, nor king; not one, nor all of these great characters, or the records they have made, have been able to set the gates ajar, so the great book of nature could be read or her mysteries explained to a world earnestly seeking the truth.

But while the ages are rolling on, every year adds a new page to the records that are made by the sweep of the centuries through the cycles of time, that helps to make up and complete the great volume of the history of a world, that helps to reveal and execute the laws that instruct and guide the people, and that describes the mechanism of a universe.

It is quite true, that there have been a few bright lights that have blazed forth like wandering stars in the centuries past. And for a time they have promised much good, and have left some results, that have benefited a world still in darkness as to the great questions of nature's economies.

But, for the want of proper data and proper effort, they did not accomplish what they desired and failed to reach the end they sought.

But while one notes the failure of others in the past to glean the true ideas from the field of thought and speculation, it would seem now that there is an abundance of evidence to be gathered from the vintage of time that may be stored for future use, to coin new ideas and form new systems of thought and establish new lines of progress, which may open up broader fields for investigation and elaborate correct views on the great questions of the present day.

But as one studies the physical and and psychical laws of the human race, as found in physiology, or examines the affinities and combinations of solids, liquids and gases, or the imponderable agents as observed in chemistry, or by the

aid of the microscope seeks the myriads of millions of infinitesimal life found in matter everywhere, or searches for the history of the sea, earth or air as shown in the ancient records of geology, or by the aid of the telescope counts, measures and weighs the worlds, suns and systems of a universe, or if one swings through the curriculum of science and carefully examines all the phenomena found, searching for all its properties, characters and conditions, he invariably arrives at one conclusion; viz., that there is one *Infinite*, *Universal* and *Eternal Energy*.

Infinite in power and resource.

Universal in dispersion and habitation.

Eternal in duration of existence.

This energy comprehends all power, executes all work and produces all phenomena, by which one judges of its character.

And this conclusion, on our part, is reached after years of diligent study and research, adhering strictly to the lines of rational and systematic thought, as indicated in scientific investigation, at all times discarding empirical and dogmatical ideas as unworthy of attention and relying on fact and phenomena to establish the views expressed.

And while, in some respects, our ideas may be novel, not heretofore considered by others, yet we have given them with a fair and unbiased judgment and believe them to be the coming sentiments of scientific knowledge.

We may not follow the conventionalities of scientific

VIRGO
THE VIRGIN

research in all respects, for we cannot sympathize with many of the views and studies which are now considered as exact science.

Many theories and statements have been unified into book form and flung to the world as great discoveries, soon to be forgotten for lack of truth.

With due respect for the opinions of the past, we are rather inclined to consider nature as we find her, treating her forces and phenomena in a common sense way, without strained conditions and without enigmatical platitudes to explain very simple laws as we observe them when investigated.

It is a trite remark that it is difficult for the human mind to transcend experience. One who has always lived in a comparatively unchanged environment will never believe in a different state of things until taught by some fresh experience.

One object in the present work is to direct the public mind to both old and new premises. As new facts and new discoveries are evolved they need elimination from the mass of topics considered and new studies, new experiments and new conclusion will be affirmed.

There are many questions and subjects before the public mind at the present time relating to nature's economy that, in the opinion of the writer, are ready for a change of views, which may result in more exact science.

EPOCHS OF DISCOVERY.

How long a time elapsed before it was brought home to men that the testimony of the unaided senses needs to be corrected by systematic observation and reasoning?

From this point of view and from others also the revolution in astronomical theory, effected by Copernicus, was one of the greatest events of human history. Its philosophic consequences were profound. It teaches the necessity of going back of superficial appearances and subjecting crude opinions to some critical test; it was an object lesson of unsurpassed value.

This system was first taught by the Greek philosopher Aristarchus of Samos in the third century before Christ.

It was long rejected and considered obsolete until Nicholas Copernicus, a Prussian astronomer, reviewed it, and he has since been considered its founder. He was born A. D. 1473 and died A. D. 1543.

About the same time arose the adventures of sea-faring enterprises, and the remarkable oceanic discoveries with their astounding results from Columbus down to Cook and Magellan enlarging four fold the dimensions of the world.

Then came Newton with his discoveries in astronomy, in which generalization from terrestrial physics was extended to the celestial spaces, but only partially verified.

There was an immense enlargement of the mental horizon and the problems immediately connected with it were enough to occupy the attention of all the foremost mathematical minds for a century.

Newton proved that the forces which kept the planets in their orbits are not strange or supernatural forces, but just such forces as we are familiar with on this earth every moment of our lives.

In geology mountains and plains, land and water have varied greatly, in which soils and climates have undergone most complicated vicissitudes in which the earth's animal and vegetable products have again and again assumed new forms, while the old forms have passed away.

Lyell proved the same forces, around us now, produced all the changes on the earth by slow processes.

For "the continual droping wears away the stone."

Then came Franklin with his kite in the air, testing the powers of nature and Faraday with his magnets and dynamos lighting and running the industries of the world and Morse with his telegraph, talking to the nations of the earth.

And the development of the so-called *imponderable agents* in the last half century has wrought a marvelous revolution in mechanical processes, in terrestrial dynamics and in human achievements. The intelligent mind is now convinced of their reality and usefulness in the development of phenomena and now believes they can be explained.

And as Copernicus dicovered the system of the cosmos that containes the great worlds, so Newton revealed the force by which they are governed, and Lyell tells us how they are built up and formed into beautiful globes of light.

GRAND EVENTS.

And thus dicoveries and experimental research have progressd till now, nations speak and salute each other over the great oceans, and lightning flies from crag to mountain tops, leaps across a continent and belts the earth six times in a second, and the dynamo whirls the factor's wheel for every industry in the land, and a world is illumed by nature's own glorious light.

And the same grand force generates the life and light for the physical form and mental vision of every being upon the earth, and moves, whirls and lights the great worlds in the heavens.

In view of these astounding facts and statements the student is encouraged in his researches and the philosopher is established in his diagnosis of the problems that are presented for consideration and to be solved according to the facts and processes of modern philosophy.

GREAT SEA OF PHENOMENA.

And as we observe the great sea of phenomena above and around us, which is presented to our view, and study its properties and analyze its laws and solve the enigma of its nature, we are allured onward from the social stratum of common life to the more elevated plains of cultivated thought. We advance to the hill sides and from them to the mountain tops of scientific lore, where we may view an intellectual light through the mists of the ages, which shall increase in brightness until it enlightens the world.

And when by the aided eye we direct our vision away into the star depths and observe the extent of a single star system and note its, apparently, limitless distances and its magnificent boundaries and thus contemplate the immensity of the whole universe and attempt to draw lines of thought commensurate with the subject, the mind is amazed, astonished and overwhelmed with the grandeur and the glory of the objects presented to our view. And as we survey the starry hosts and observe their times, seasons and years, their numbers, magnitudes and distances, and as we note the progress of science in every department of knowledge the wonder is that the philosopher has accomplished such a mighty work in the discovery and analysis of the phenomena catalogued in his records.

But with his best efforts, with all the aid that science can give him, the amount of knowledge that has been gained thus far is comparatively small in view of the great fields in the arcanum of nature yet to be investigated.

But so wise is the constitution of things that the inquiring spirit must ever find some desire unsatisfied, some secret entity unrevealed, some land undiscovered to the visions of genius.

And yet the searching mind moves on from conquest to conquest, the theme allures him on by all the mystery of the promised future and all the sublime glory now possessed.

In making this search his implements are drawn from the armory of heaven, the domain is wide as the universe.

Many of the great problems of nature have been solved, the world is no longer a mystery, but a museum of revealed facts.

To prove these triumphs in the latter days when all the lights of former times are concentrated upon us let the young student adjust the powers of his microscope and turn towards the lower orders of creation.

In the field of chemistry let him count the numbers and measure the size of the molecules in a cubic inch of gas, let him number the particles thrown off a single grain of musk for twenty years without deminution of size, or number the vibrations of light waves in a second of time and measure their wave lengths, let him tell the number of living microbes in the human body and investigate the number and minuteness of the animal shells that compose the chalk beds, or measure the misty particles of the storm cloud.

Again he harnesses light to his telescope and turns toward the heavens, he commences his flight, he passes the Moon, Mercury and Venus, compasses the circle of the Sun, passes Jupiter with his belts, and Saturn with his rings and satellites, goes beyond Orion and the Pleiades till he penetrates the milky way and then he pauses and wonders to find each particle a living star.

Again he examines the clustered Nebulæ, separates them into single orbs, and returning to his study he writes all these mysterious phenomena in the catalogue of human knowledge.

He ascends again, passes suns, stars and nebulæ till standing on the verge of distant creation, he sees with the eye of his spirit this whole system of ours, suns, planets and satellites.

"Hanging in a golden chain this pendent world in bigness as a star of smallest magnitude."

This ascent of physical science through the material world has been but the type of ascending flight of the human mind through the realms of knowledge. It is the conquest of mind over matter.

The spirit has gone forth chainless as the mountain air, free as the beams of morning light.

The dark ignorance of savage life is gone and now man with mature intellect comes to erect the temples of liberty on the verdure crowned hills of enlightened civilization.

The frown, once placed on the brow of nature, is removed. The stars no longer shoot terrors across the horizon, the sun no longer veils his face in anger, though darkened by an eclipse.

We stand high on the vantage ground of knowledge. Light smiles out from every wandering orb, and eternal beauty rests on all the works of God.

RATIONAL AND EMPIRICAL PHILOSOPHY.

The age is highly progressive and nothing escapes the searching investigation of the human mind.

"The adventures of the gods, the inventions of men, the exploits of heroes and the fancies of poets are recorded in the journals and magazines of the day and analyzed in the crucible of the critic and the pure gems of thought freed from the errors of unlettered scribes, and the must of ages, are garnered into the archives of the world's history.

In literature, art and science the intellect has evoluted from a mere point, like a star gem in the skies, to the magnitude of a whirling world.

The grasp of ideas, and the skill, ability and energy showing how they are used and applied, demonstrate the fact that the intellect of the race is endued with marvelous power.

The development of fact and fiction in the plots and themes of writers of the present day, the history, biography and news of the daily press were never more elaborate and bolder in their expression, never more self-reliant and defiant than now.

The creations of beauty and grandeur and the sublime conceptions of works of art in our studios were never excelled.

The minuteness of particles and the affinities of chemistry, which reveal the material of which worlds are made and

Schedir
CASSIOPEIA

the laws by which they are governed, is demonstrated by experimental research.

And the manner in which these materials are arranged and combined is explained by geology.

The magnificent display of worlds, suns and systems, observed as we survey the boundless expanse of the star depths, is revealed by the telescope and explained on the pages of astronomy.

The elevation of the race from human bondage and barbaric society to the condition of enlightened free men is now guaranteed by the Ægis of the bird that represents the American Republic.

The human mind, freed from the pall of ignorance and superstition, which banished intelligent thought from the public weal and which was dominated by the teaching of the cabalistic creeds of an ancient hierarchy, may now rejoice in the halls of learning and drink at the fountain of eternal truth, and every one capable and worthy may to-day dwell in the temple of civil and religious liberty and enjoy all the rights and blessings of a regenerated race.

All these statements and conditions of cultured development prove that the enlightened world is making gigantic strides in general progress and is marching on amid the triumphs of an intellectual conquest far beyond the dream of human thought.

In view of these grand achievements of the human intellect and the grand work accomplished by the nations of

the earth and the renown they merit and enjoy for their discoveries in science, art and industries, there are yet questions to be solved, errors to be corrected and mistakes to be rectified in the formulas and processes that are adopted in the practice of almost every profession of life, in science hygiene, religion, politics, society and the occult.

In all these departments of knowledge there are lapses from the truth in theory and practice by the professional devotee that surprise and puzzle the profound thinkers upon these topics.

But the diligent student of nature never wearies in his search for the reason why, and the phenomena, hitherto unexplained, now enter nature's great laboratory, and the search continues until the mystery is solved.

By the aid of superior instruments new discoveries have been made, new processes have been used, new delineations have been outlined and the proof is at hand, and the catalogues of scientific discoveries are greatly enlarged.

But in all branches of learning there is much labor required to verify facts.

Varied opinions have often been expressed upon various topics in Astronomy, Meteorology and in Geology, especially upon the motions and laws of the planets, their light and heat, and the light, heat, photosphere and spots of the sun.

In Meteorology different views are held as to the origin and nature of the atmosphere and the gases, the cause of evaporation, winds and storms and the phenomena of motion and life.

In Geology we have the origin of matter to discuss and its formation into masses, the processes of crystallization and the origin of rocks, earths, gems, air and water.

All these topics have repeatedly been under the rigid investigation of the scientist's pen and varied conclusions have been the result. Many of these conclusions are, in the opinion of the writer, foreign to the truth.

The nature of the elements and attributes of these phenomena have been difficult to seek out, and many empirical conclusions have been reached without giving the reason why.

Sir Isaac Newton gave the precedent for this mode of research when he undertook to establish the law, *of inversely as the square of the distances for the dispersion of light, heat and gravity*, which he elaborately set forth in his Principia.

This law is true as to local and radiant bodies, but it is not true as to distant and insulated bodies.

Newton acknowledged his failure for the want of proper data and claimed to partly cover his difficulty by naming two motions—centripetal, tending to the centre; centrifugal, tending from the centre.

He also, to be consistant, claimed that the sun was a hot body, with a temperature of more than three million degrees of heat.

This temperature he deemed necessary in order that the sun's light and heat might reach the earth and other planets in the solar system by radiation.

Other writers since Newton have deemed it necessary that the sun's temperature should be much higher in order to coincide with Newton's theory.

But let us consider a moment.

The extreme distances of the planets from the sun range from Mercury, the nearest, at thirty-six million miles, to Neptune, the farthest, at less than three billion miles. These are pretty long distances for light and heat to be radiated from any body, large or small, and this view is emphasized when we consider the enormous weight of the great globes and the force necessary to control them in their orbits. (See chapter on Sun's Energy.)

How much light, heat or energy radiated from the sun would reach Neptune?

John Tyndall says: That heat radiated from the sun inversely as the square of the distances would render the planets frigid.—*Heat a mode of motion.*

John Tyndall was one of the ablest writers known, on cosmical physics.

And he was right. His views on this question as on many others were sound and safe in a scientific sense.

Again, the sun is composed of matter in some form, either solid, liquid or gaseous. Many writers are of opinion that the last is the correct one. But it matters not what the form is, for it could not exist in any form in such an excited temperature.

The hardest substances known to the chemist are vaporized at a temperature from two thousand to four thousand degrees. The highest artificial heat practical is used in separating the metal Aluminum, which requires a temperature of 6,000 degrees. The difference between the temperature of these conditions and that of the supposed temperature of the sun is enormous and can not be accepted according to any known laws of physics, and this hypothesis can only be considered as an empirical dictum forced upon the mind by the unexplained phenomena observed on the sun.

NOTE—In a subsequent number of this work, under the head of Solar Physics, these subjects are more fully elaborated, new premises are presented, and the reason why is given.

MEDICAL SCIENCE.

In medical science there has been a wide field of discussion on the topics of hygiene and pathology from the earliest history until now.

But it has long been a question among eminent men whether medical practice has been any benefit to mankind as a healing art.

That some of the most absurd treatments for ailments were practiced in former times by men who stood foremost in the world's activities is true. And the wisest ones of the profession announce their doubts as to the efficacy of medication as practiced even at the present day.

For generations the fathers have learned by experiment, often by the sacrifice of life, that certain remedies gave certain results and the sons following in the same line con-

tinued the same practice, because their fathers did the same before them; neither father nor son knowing the reason why the remedy produced the results expected.

Dr. Oliver Wendell Holmes, now deceased, lecturer in Harvard Medical School, says: With the exception of morphine and sulphuric ether I firmly believe that *if the whole Meteria Medica could be sunk in the bottom of the sea* it would be all the better for mankind—and all the worse for the fishes.

Dr. Jacob Bigelow, professor in Harvard University, says: The premature death of medical men brings with it the humiliating conclusion that while the other sciences have been carried forward within our own time and almost under our own eyes, to a degree of unprecedented advancement, medicine, in regard to some of its professed and important objects, *the cure of disease*, *is still an ineffectual speculation.*

Dr. Chapman, professor in the University of Pennsylvania, says: Nowhere is the imagination displayed to a greater extent, and perhaps, so ample an exhibition of human invention, might gratify our vanity if it were not more than compensated by the humiliating view of so much *absurdity*, *contradiction and falsehood.*

Dr. Mason Good, late learned professor in London, says: The science of medicine is an unintelligible jargon and the effects of our medicine on the human system are in the highest degree uncertain, except, indeed, that they have already destroyed more lives than *war*, *pestilence and famine combined.*

Dr. J. Abercrombie, fellow of the Royal Society, England, says: Medicine has been called by philosophers the art of conjecturing—the science of guessing.

Sir Astly Cooper said: That more harm than good is done by medication.

Thomas Carlyle says: It yields a money result only.

Voltaire says: The art of medicine consists in amusing the patient while nature cures the disease.

These facts are a bold and stinging arraignment of a profession by its own devotees, especially, one as widely known as the Healing Art.

Many lives have been sacrificed by the malpractice of the skilled physician. But it was not on account of any fault or intention on the part of the individual, but it was the errors of the Professional Technique that took the life of the patient.

The whole profession has been characterized as experimental from Esculapius down to the present day.

It proves that very little has been accomplished by rational processes, but much has been done by empirical travesties to the injury of a suffering world.

III.

SPECTRUM OF NATURE.

In the contemplation of the economy of nature, in the revelation of her mysteries and in the accomplishment of her designs, as conceived in the earth and universe, through the activity of cosmical processes, as observed in our researches, two potentials are evoluted, elaborated and revealed to human knowledge,

MATTER AND ENERGY.

These are primordial conditions and both matter and energy are essential to the existence of the cosmos.

Both potentials occupy the cosmos conjointly in either a dense or diffused state and generate phenomena by one effort, acting in unity.

Both are natural, inherent, infinite in extent and eternal in duration.

Not one atom of matter or one unit of energy is ever lost.

Gemini

THE TWINS

These unified potentials have been erroneously called by different names. Each name representing a single function, *as an Essence*, *an Ether*, *a Plasm*, *a Medium*. While the potentials proper have many functions.

A few writers upon these topics—Sir William Thompson, Sir Oliver Lodge et al—have included both matter and energy, in one universal Medium or Energy. They hold: that in the course of cosmical processes matter is evoluted into separate conditions from the energy, either as integral units, or molecules, or massed into organic or inorganic forms. But we have chosen to treat them mainly as integral, for that is the first form in which we know either of them. When unified as one energy they are unknown quantities. Therefore, we speak of them as we find them in both the integral and unified forms.

In the interpretation of the properties and characteristics of the energy we can present here only a few of the more leading topics. The more important, especially the elements, of matter and attributes of energy are elaborated in their proper places in the different parts of the work.

And in speaking of the elements and attributes we may use the more comprehensive term energy, to represent them both.

ENERGY DEFINED.

The interpretation of Energy, as often used in this work, signifies an agent, actor, or doer, that possesses power and capacity to perform work.

It comprehends the attributes and functions represented in the manifestations by natural forces.

All these manifestations, by similar processes, exhibit natural phenomena, generated by one agent, one Energy, operating in differential environments, in differential media, with differential degrees of power, force and motion. It has capacity, for moving matter by strain, for causing motion against resistance.

It generates forces, executes work and displays grand phenomena.

It originates material, organizes it into form, endues it with force and motion, projects it into activity, controls and operates all natural bodies.

Thus Energy is a general term, used in a liberal sense, and includes all the meaning implied in the highest, grandest and most powerful manifestations of nature's marvelous forces.

It includes the subjective and objective, the attecedent and consequent, the cause and effect of natural phenomena and comprehends all the varied forms of natural power, force and motion.

Briefly stated, the functions of the Energy are to generate power, force and motion, to mould and shape matter into typical forms and to endue it with life.

At the same time motion, form, sound, heat and light are attendant phenomena, which are evoluted by the processes of the Energy while doing its work.

And the manifestations of these processes are all graded according to the medium or kind of matter, the Energy is required to act upon and according to the environment in which it is found.

The field in which the Energy operates and elaborates its processes is as broad and unlimited as the cosmos. For the Energy is *infinite in extent*, *infinite in duration*, *power and intelligence*.

FUNCTIONS OF MATTER.

Matter affords mediums and bodies for the creation and display of various phenomena, to equip worlds and systems of worlds, to occupy a place in the Universal Cosmos.

All writers upon cosmical topics agree, that what is known as the interstellar medium, which is considered as an example of the most attenuated form of matter, is composed of atoms and molecules, and it is also agreed by able writers, as we show later, that an atom is a point of substance, clothed with a garment of force and indued with intelligence, and that two or more atoms form a molecule. These are conditions essential to the existance of any substance.

Then Matter indued with Energy constitutes a medium, and when there is a medium there may be phenomena. And, moreover, there is no medium and, consequently, no phenomena without the combination or union of the two potentials—Matter and Energy—in every environment in which they act.

This may be further shown by the vacuum tube, if the tube approaches a perfect vacuum no phenomena of any kind appears. It is totally dark and void, like chaos. Neither light, heat nor motion can be produced in it, or can pass through it. But the moment the slightest medium of any kind of matter is passed into it and a current of electricity is sent through it then light, heat and motion are present.

We conclude then that matter forms the medium or basis of all phenomena when acted upon by the energy. And we have shown that there can be no phenomena of any kind unless matter and energy both are acting or operating in the same environment.

Then Form, Sound, Heat, Light and Life are all manifestations of matter, for neither will appear unless matter is present.

To elaborate the combinations and dissolutions of these two potentials, then, is one object of this effort.

VISIONS OF A UNIVERSE.

In the general survey of the character and attributes of the energy it may be desirable to become partially acquainted with its habitat, to learn the extent of its operations, to observe its functions, to study its processes in the broadest fields, to seek for its highest and grandest activities that may be discovered in the cosmos.

And when one has obtained a glimpse of the magnitude of this field of vision he will be the more ready to work and wonder while he searches for the ultimate origin, cause and character of the phenomena observed.

INTERSTELLAR MEDIUM.

As before stated, most writers upon cosmical topics concede the fact of the existence of an Interstellar Medium. As to the nature and character of this medium—a theme of wide and varied discussion—we will not now note in detail, later on we shall condense in a few paragraphs a concise consensus of opinion of this Medium and its character.

Let it suffice here to say that the general opinion is, that its capacity is not equal to its environment, so far as now understood.

But when its character is more completely revealed and its functions and attributes are better known it may then be considered a leading element in cosmical phenomena.

It is the medium that carries the Firemist or world stuff, and in which float the cloudy masses of ethereal matter that supply the meteoric showers, the nebulæ and the great globes that swing and vibrate throughout space.

FORMS OF MATTER.

Many able writers are of opinion that the original or first form of all matter was gaseous.

The spectroscope proves that space is occupied by gaseous substances.

That meteoric Clouds, Comets, and many of the Nebulæ are of this form, even the Sun, by some, is believed to be only a gaseous bubble. (See Art, the Sun). And there are strong evidences that would seem to prove that the larger planets, especially Jupiter and Saturn, with their belts and rings and their cloudy conopies, are still in the formative or gaseous state.

But it is possible and, indeed, probable that when we view these great orbs through the telescope we look upon their atmospheres—they certainly have atmospheres or else they would not shine—and their nucleus may still be dark and liquid, or solid, or both, like the earth and other planets.

But the density of these globes, as we now know it, forbids the supposition that they may be solid.

Distilled water is the standard of measurement of density for liquids and solids, as air is the standard for the gases.

Water then is 1 and our earth, a solid body, is 5.6 times as heavy as water.

But the Sun, Jupiter and Saturn are each only one-fourth or 1.4 as dense as our earth, about as dense as water slightly riled. But these orbs are all very large bodies and if they were gaseous they might equal one-fourth the earth's density. The smaller planets are denser and doubtless inhabited by living beings in some form.

NEBULOUS THEORY.

And if we accept the Nebulous Theory, which is the only rational explanation of cosmical processes, we are compelled to believe that the earth and other solid bodies, now floating in space, were at one time only gaseous bubbles.

(In this number we shall not attempt to elaborate the processes of the energy to produce these results. Our object here is simply to show that these changes do occur. Later we shall explain them fully.)

That these conditions exist in space and that the evolution of forms and substances is in constant procedure cannot be doubted.

INFINITE SPACE.

And it should be distinctly borne in mind that space is one grand environment, in which matter or substance exists in different states and in which it is moulded and shaped into form either gaseous, liquid or solid, and in which it continually abides. And that Fire Mist, Comets, Nebulæ, Worlds, Suns and Systems are all floating, whirling and shining in their eternal rounds *forever*, and in this harmonious whole we have a completed cosmos or universe.

Thus from a very minute and attenuated form of matter existing in the cosmic medium there grow mighty and ponderous masses of matter or substances into gaseous or solid forms. This Medium is not usually known as the

FIRE MIST,

but is often mentioned by writers as the Luminiferous Ether

of Space, for the reason that Comets and Nebulæ float in it and when they appear they shine and are luminous.

To illustrate some of the processes by which this world matter changes its form, let the inside of two tumblers be smeared by using a feather, one with *muriatic acid*, the other with *ammonia*. By keeping the tumblers separate there will arise from each glass an *invisible* gas, with a very pungent odor.

When the glasses are brought close together the gases will unite, an odorless white cloud will appear over them and a precipitation follows and brings down a new *salt* or compound, known as *Sal Ammoniac*.

Water at 212° Fahrenheit generates steam, a colorless and odorless medium. When steam is liberated it is immediately converted into a white vapor, and if the air is cold the vapor is precipitated into raindrops.

Prof. John Tyndall says: But it is a fact that in the atmosphere we have particles of matter which defy the microscope and the balance which do not darken the air, but which exist nevertheless in countless multitudes sufficient to reduce to insignificance the Israelitish hyperbole, regarding the sands upon the sea shore.

These particles, doubtless, are brought into the atmosphere by the explosion of meteoric vapors, brought down from ethereal space, and are identical with the cosmic dust

ANDROMEDA

or Firemist, of which comets, nebulæ and worlds are made. (See Olmsted in Burritt's Astronomy.)

Prof. Proctor in his lectures in Steinway Hall, New York, says: When we take into account the meteors falling we find that in the course of a year four hundred million of meteoric processes fall upon the earth and form a part of it. The computation we could make would make hundreds of thousands of tons. Thus it is that the earth grows, and though the increase is infinitely small compared with actual masses, yet through the countless years the earth has passed, no small power has been added to its growth. A large part of the earth must have accrued in in this particular way, through the enormous periods we have to deal with.

This view seems to coincide with the opinion of many writers that the summer haze and smoky autumns and the floating dust of the air, supposed by some to be volcanic ashes, the colored and tinted snows and the dust clouds and masses gathered on the ruins of old cities come from Ethereal Space, settle in the air and are finally deposited upon the earth.

Many of these cities have deposits several feet deep. The foundation walls of old Jerusalem were found twenty-six feet below the present surface. And the ruins of ancient Troy, Babylon and Nineveh were found much deeper. And it may be observed as a fact that in city or country there is a continual falling and precipitation of the *Dust of Time.*

And the casual observer has no idea from whence it comes, and yet it comes and comes continually and *forever*.

This would corroborate the fact that there is a constant precipitation of cosmic matter upon the earth and doubtless upon the other planets, which is gathered up and held by them in their orbital sweeps through space.

Again, when a storm centre is formed in the air the misty particles of vapor become condensed, forming clouds. And when the cloud has become saturated, the moisture is then precipitated upon the earth in the form of rain, which forms the rivers, lakes and oceans.

In pools and sluggish streams, solid vegetable matter, rocky and alluvial soils are often dissolved and held in suspension for a time, but are finally precipitated upon the bottom and form laminated strata for new rocky formations.

And the more rapid streams, with swift currents, erode their banks and wash down the soils and carry them to their mouths and precipitate the silt on the bottom of the sea, forming deltas.

And the same cosmical matter of space rushes down upon the great seas and oceans and forms the viscous mass or plasm that broods the germ life of the sea and forms the basis of the germinal matter known as protoplasm found on sea bottoms the world over. Immense areas of this protoplasm have been discovered in many sea beds by exploring expeditions. In space this matter gives form and light to fire mist and comets and upon the earth and in the sea it gives form, light and life.

ORIGIN OF WORLDS.

And it is claimed by eminent writers that this cosmic plasm becomes condensed upon the earth and forms her atmosphere and the gases, and that from the condensation and combination of these gases the sea, earth and air are condensed liquidfied and solidified into permanent form and fitted for the abode of life.

For out of this spacial plasm has been precipitated all the material that builds up the great globes and equips them for a journey through the skies.

And as matter is found in the Interstellar Medium so it is found in the Atmospheric Medium, which envelopes the earth, and in the Oceanic Medium, which washes the earth from shore to shore. And in either environment the material is brought down and precipitated into solid and permanent form. And this is the principle process by which matter is moulded, shaped and grown into mighty worlds.

The work moves slowly and requires an eternity of duration to build up a completed world.

The processes of the Energy by which this grand work is accomplished will be described in a later number.

FORMS OF NEBULÆ.

The lighter forms of this world matter as seen through the telescope have the appearance of a cloudy haze, bunched in great masses and extending over immense fields of space. This matter may assume various forms, as the globular, striated or disk like shape, with dark cave like

interiors and light surface and edges, shining by their own inherent light, the same as all large bodies in the cosmos, only not as brilliant, for the reason that their atmospheres are not completely formed and their mass is not as dense as other large bodies that shine.

They appear to be in constant motion, moving in linear directions, but doubtless circling around some grand cosmic center, requiring ages of time to perform one revolution. (See plate.)

They have a rotary motion on axial lines, and as they grow denser their motion increases and large portions of the unwieldy mass are bi-sected and thrown off from the parent mass, and this separated part also assumes motions of its own, both axial and orbital, around its parent mass.

Thus these immense fields of cosmic matter, when condensed into central masses, assume motions and are divided up into worlds, suns and systems, like our own, which we call the solar system, consisting of one sun, eight primary planets and twenty-two satellites or moons and about 300 planetoids or small bodies between Mars and Jupiter.

Many of these Nebulæ are found in the constellations Cassiopeia, Orion, Hercules and the Swan.

Many are attenuated in Mass, appearing like clouds in the Ether. Others are more condensed and older, giving bright light and appearing like planets or suns, but they still retain the nebulous condition. (See plate.)

VIA LACTEA.

The second variety of Nebulæ is found in great fields, like the Milky Way, which constitutes a firmament of itself.

In this annular pathway around the sky, there are thousands of starry clusters of worlds and suns strung upon this golden belt.

And many of these masses as far exceed our solar system in magnitude and splendor as the plane of the earth's orbit around the sun, which is 600,000,000 of miles in circumference, exceeds a mere point.

And the luster of the light of these clusters comes to us billions of miles away through the dim vista of the mazy expanse of the starry concave and throws a glamour of vision over the observer, which we name Ether Clouds or Nebulæ, as seen by the unassisted eye.

But when the telescope is directed toward these immense fields of space, what appeared to be a thin cloudy mass of vapor is changed, as by magical vision, into spangled gems set in coronets and diadems of gold in the far off star depths.

The fixed star, which we call our sun, belongs to that extensive system of Nebulæ, the Milky Way, and although apparently at such an immeasurable distance from its fellows is, doubtless, as near to any one of them as they are to each other.

It appears from numerous observations that various changes are taking place among the Nebulæ, that several

Nebulæ are formed by the dissolution of larger ones, and are detaching themselves from the Milky Way.

"These changes seem to indicate that mighty movements and vast operations are continually going on in the distant regions of the Universe upon a scale of magnitude and grandeur which baffles the human understanding. Many thousands of these Nebulæ have been observed and if each contains as many stars as the Milky Way many hundred millions of stars must exist, even in that portion of the heavens which lies open to our observation."

Thus when viewed by the telescope the heavens present a very different appearance than when viewed by the naked eye, for new fields of starlit space are presented to our view. What appeared a thin cloudy mass of vapor proves to be a cluster of millions of bright gems, which may be resolved into worlds and suns, many of them much larger than our own.

FIXED STARS.

As to the number, magnitude and distance of the stars nothing can be definitely and accurately known. But we can safely say that their number is countless, their magnitude immense and their distance beyond computation.

An eminent writer says: It has been computed that one hundred millions of stars which cannot be discovered by the naked eye are now visible through the telescope. And yet this vast assemblage of worlds and suns may bear no greater proportion to what lies beyond the utmost

boundaries of human vision than a drop of water to the ocean, and if stricken out of being would be no more missed to an eye that could take in the Universe than the fall of a single leaf from the forest.

Dr. Herschel informs us that when examining the Milky Way with his best glasses he saw and counted 588 stars in a single spot without moving his telescope, and as the gradual rotary motion of the earth carried these out of view and introduced others successively in their places, while he kept his telescope steadily fixed to one point there passed over his field of vision in the space of one quarter of an hour no less than one hundred and sixteen thousand stars; and at another time in forty-two minutes no less than two hundred and fifty-eight thousand. In all parts of the Milky Way he found the stars unequally dispersed and appearing to arrange themselves into separate clusters. In one small space in Cygni the stars seem to be clustering in two divisions, each division containing upwards of two hundred and sixty-five thousand stars.

In a space one yard in breadth and six in length he discovered fifty thousand stars large enough to be distinctly counted, and he suspected twice as many more which, for want of sufficient light in his telescope, he saw only now and then.

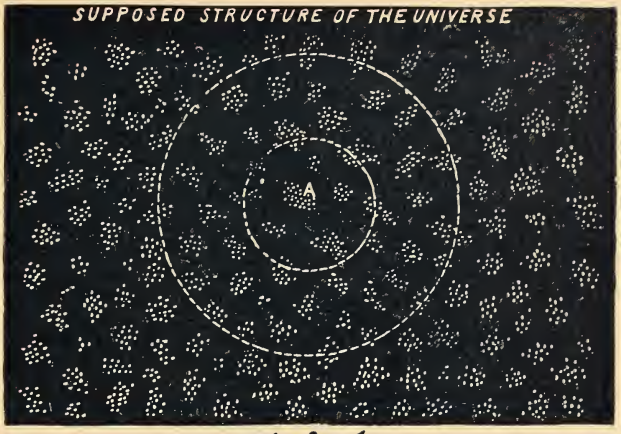


Fig. 1.

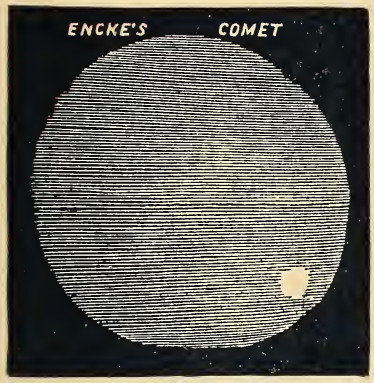


Fig. 2.

Fig. 3.

Fig. 4.

Fig. 1.

Fig. 2.

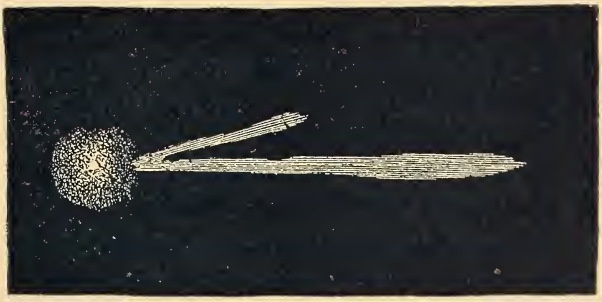


Fig. 3.

IV.

ILLUSTRATIONS.

By the kindness of Mr. C. H. Gallion, of the University of Chicago, the writer obtained a photograph of Yerkes' Telescope, as represented at the World's Fair, from which the illustration, here used, was produced; and permission was given to publish in whole or in part Prof. See's article on the Telescope, in the *University of Chicago Weekly*, as follows:

THE YERKES TELESCOPE.

As the Yerkes Telescope is the latest in design, and embodies the results of past experience in the construction and manipulation of great Telescopes, a short description of this instrument will doubtless be of interest.

The glass for the great Telescope was cast in Paris by the celebrated firm of Mantois, and was originally intended for the University of Southern California, at Los Angeles. Owing to financial reverses the university never began the observatory. With the final result that Mr. Yerkes not only purchased the glass but provided for a complete observatory of imposing grandeur.

The great lens has 40 inches of clear aperture, is over three inches in thickness, and weighs over 750 pounds. The Yerkes 40 inch will therefore be considerably more

powerful than any telescope hitherto constructed, and if judiciously applied to the heavens can hardly fail to bring to light discoveries of priceless value.

The great Telescope has been constructed by the celebrated firm of Warner and Swasey of Cleveland, Ohio, and is regarded as the greatest of their many triumphs in the the manufacture of great Telescopes. The illustration will convey a better idea of the Telescope than any description, but a few figures may be of interest.

The tube is of sheet steel, 42 inches in diameter at the objective end, 52 inches in diameter at the middle, and weighs 6 tons. The pier is of cast iron, and stands about 44 feet in height; when the Telescope tube is pointed to the Zenith the glass is about 75 feet from the ground. The length of the tube is 64, and when the long spectroscope is adjusted the total length of the apparatus is nearly 70 feet. The dome will have a diameter of 80 feet, and a height of about 100 feet. The declination axis is 12 inches in diameter and 12 feet long and weighs 1½ tons; the polar axis is 15 inches in diameter at the upper bearing, 12 inches at the lower bearing, and weighs 3½ tons.

The Telescope is manipulated entirely by electricity, and the astronomer at the eye-end by simply pressing a button can move the instrument in any desired direction. The floor of the observatory will be raised by electric motor power, so that the observers can reach the eye-end of the Telescope without difficulty. It is understood that the great

Telescope will be used for observations which require great light-gathering power, such as measuring difficult double stars, observing faint satellites, nebulæ and comets, and for the investigation of the spectra of the heavenly bodies. Smaller Telescopes and other apparatus will be provided for other lines of research. It will thus be seen that the University of Chicago will have unequalled facilities for research in observational astronomy.

It is gratifying to know that the Department of Astronomy is to be as strong in Mathematical Astronomy or Celestial Mechanics as it will be in the direction of practical observation. It is of course chiefly optical discoveries which are made with Telescopes; the profounder discoveries of the physical cause of things, and the laws of their phenomena, can be made only by applications of mathematics involving intellectual powers of the highest order, and long continued training in the highest branches of analysis. It is chiefly by the application of analysis to astronomy that the science has reached its present exalted eminence among the physical sciences, and the present state of the planetary theories could never have been attained except by steadfastly following the paths struck out by Newton, Laplace and Leverrier.

CELESTIAL ATLAS.

The parts of this work, descriptive of Astronomical Topics, will be accompanied by a colored Celestial Atlas, size 24x26 inches, representing the Constellations of the heavens. It is highly illustrated by the weird and grotesque forms of the Mythological characters of the Ancients.

It is artistic, methodical, scholarly and occupies a position difficult to fill by any other work of several times its cost.

We have used a few of the figures with their descriptions as special illustrations — Virgo, Cassiopeia, Andromeda, Orion, Gemini and Ursi Major.

This Atlas is usually accompanied by a popular work known as Burritt's Astronomy.

Both are published and for sale by Sheldon and Company, New York, N. Y.

URSI MAJOR. (The Great Bear.)

This constellation is on the Meridian in May.

It is situated in the northern heavens near the North Pole and is readily distinguished from all others by means of a remarkable cluster of seven bright stars, forming what is familiarly termed the *Dipper.*

A remarkable coincidence occurs in the recognition of this constellation.

The priests of Belus and the Magi of Persia, the shepherds of Chaldea and Phœnician navigators, the ancient American Aborigines, (The Iroquois), and the earliest Arabs of Asia were equally impressed with its remarkable outlines and gave to the same Constellation the name of "Great Bear".

A line drawn through the two eastern stars of the Dipper points to the North Star.

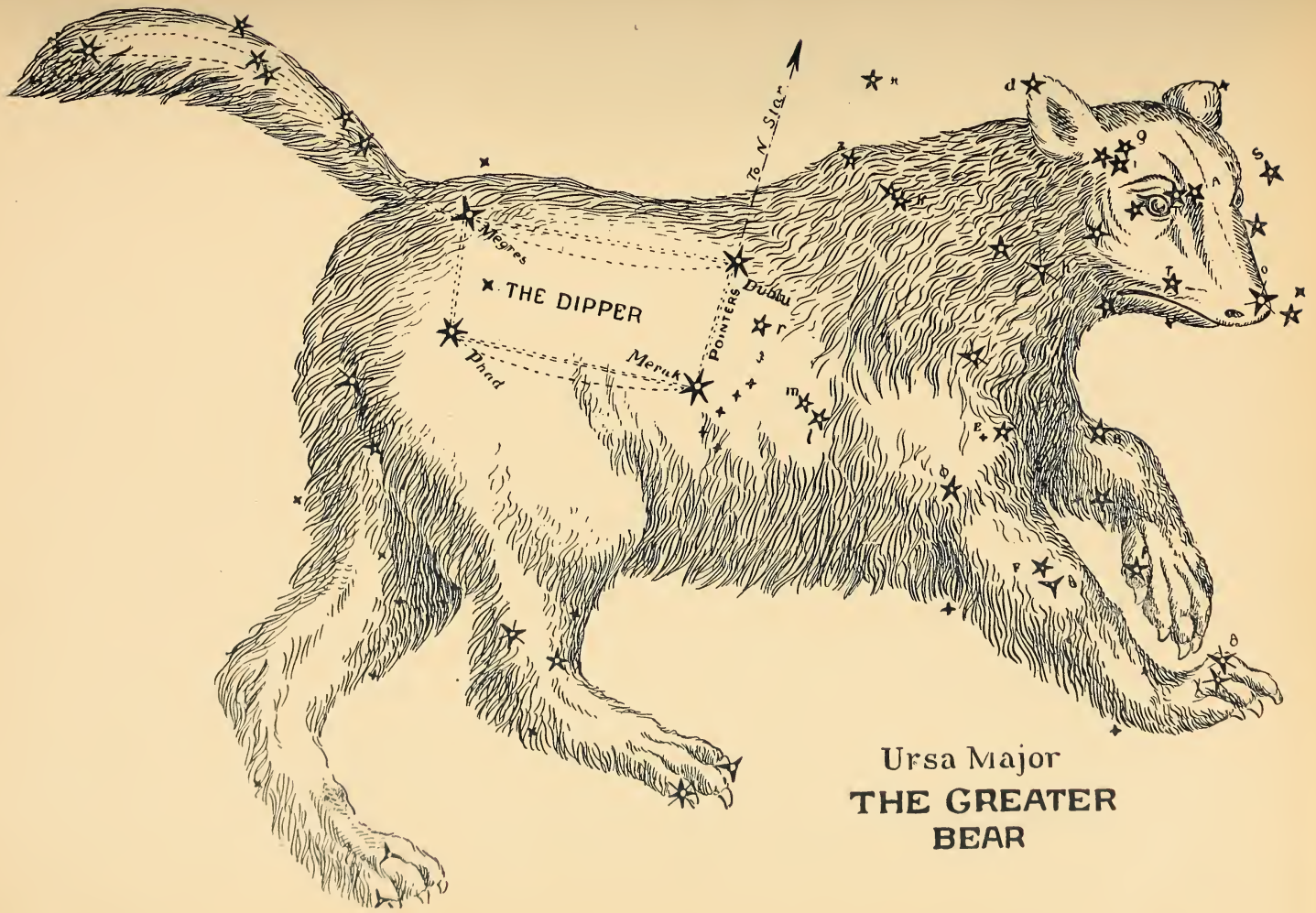
Megrez, at the junction of the handle, is used both on sea and land for important purposes.

Of the visible stars five are of the second, two of the third and twice as many of the fourth magnitude. Several of these stars shine with beautiful variegated colors, viz yellow, pale yellow, topaz yellow, white, brilliant white, emerald, purple, orange tint and cornelian. This part of the heavens is abundantly supplied with remarkable fields of nebulæ and starry matter. No less than eight large masses appear, large, oval, eliptical and nucleated in shape.

NOTE—The observer should reverse the maps from east to west, and hold them overhead so the top will be towards the north, excepting the polar maps.

CASSIOPEIA.

Cassiopeia is a beautiful Constellation lying eastward and opposite of the big Dipper, and may be readily distin-



Ursa Major

THE GREATER BEAR

guished by six bright stars in the form of the letter W—Caph, an important star in this letter, is directly opposite Megrez in the Dipper. It is the same distance from the Polar Star, and both lie in the Equinoctial Colure. Shedir, the highest star in the letter, is in Cassiopeia's breast.

The position of Caph concerns the mariner and surveyor.

It is used in connection with observations on the Polar Star for determining the latitude of places and for discovering magnetic variations of the needle.

It also helps to find the true pole of the heavens. For the North Polar Star is situated 1° 31' from the true Pole, in the direction toward Caph.

LOST STARS.

Caph marks a spot on the starry heavens, rendered memorable as being the place of a lost star. Three hundred and twenty-two years ago a bright star shone 5° N. N. E. of Caph, where now is a dark void.

"It is impossible," says Mrs. Somerville, "to imagine anything more tremendous than a conflagration that could be visible at such a distance." It was seen for sixteen months. Some astronomers imagined that it would re-appear again after 150 years, but it has never been discovered since. This phenomenon alarmed all the astronomers of the age who beheld it, and many of them wrote dissertations concerning it.

TELESCOPIC OBJECTS.

The Constellation of Cassiopeia contains many stars that are visible to the naked eye, of which four are of the third

CASSIOPEIA

magnitude and so situated as to form, with one or two smaller ones, the figure of an inverted chair.

The stars in this group, as in all others, have beautiful variegated colors.

There are several binary, double, triple, quadruple and other fine clusters and fields of brilliant stars.

Cassiopeia is on the Meridian the 22nd of December, but may be seen in our latitude almost any season of the year.

Its right ascension is 12° and its mean declination 60° N.

ANDROMEDA.

Andromeda is represented on the Celestial Atlas by the figure of a woman chained to a rock and is on the Meridian November 10th. It is immediately south of Cassiopeia.

Andromeda has a few visible stars, three of the second magnitude and two of third, others are smaller.

HISTORY.

Cassiopeia was the wife of Cepheus, King of Ethiopia, and mother of Andromeda. She was a queen of matchless beauty, and seemed to be sensible of it; for she even boasted herself fairer than Juno, the sister of Jupiter, or the Nereides —a name given to the sea nymphs. This so provoked the ladies of the sea, that they complained to Neptune of the insult, who sent a frightful monster to ravage her coast, as a punishment for her insolence. But the anger of Neptune and the jealousy of the nymphs were not thus appeased. They demanded, and it was finally ordained that Cassiopeia should chain her daughter Andromeda, whom she tenderly

ANDROMEDA

loved, to a desert rock on the beach, and leave her exposed to the fury of this monster. She was thus left, and the monster approached; but just as he was going to devour her, Perseus killed him.

ORION.

Orion is a splendid Constellation. It lies midway between the poles of the heavens, about 8° W. of the solstitial Colure and comes to the Meridian on the 23rd of January It is represented on the Celestial Maps by the figure of a man in the attitude of assaulting the Bull or Taurus, which represents a near constellation. He has a sword in his belt, a huge club in his right hand and a lion's skin in his left, to serve for a shield. Four brilliant stars, in the form of a parallelogram intersected in the middle by the "Ell and Yard", or belt, and sword form the outlines of Orion. The figure fronts north.

The names of the stars forming this figure are *Rigel*, a splendid star in the left foot on the west; *Saiph* is a star in the right knee 8½° east of Rigel; *Bellatrix* is a star on the left shoulder; *Betelguese* is a star on the right shoulder above Rigel.

There is a little triangle in the head of Orion, and this forms another triangle with the stars in his shoulders.

The "three stars" in his belt are also called the Bands of Orion. They point to the Hyades and Pleiades on one side and Sirius or Dog Star on the other. They measure 3° in length and are used as the standard for measuring the distance of the stars.

Mintaka, the northernmost star in the belt, is less than ½° south of the Equinoctial, and when on the Meridian is almost exactly over the Equator. There is a row of stars

Meissa
Betelgueuse
Bellatrix
Mintaka
Anilam
Alnitak
Thabit
Saiph
Nibal
ORION

of the fourth magnitude S. of the belt running diagonally towards Saiph, which forms the sword. This row is also called the Ell, because it is once and a quarter the length of the Yard or belt.

West of Orion are eight stars, these point out the skin of the lion in his left hand.

TELESCOPIC OBJECTS.

There are many visible stars in this constellation, of which two are of the first magnitude, four of the second, three of the third and fifteen of the fourth.

Orion is a rich field of star clusters and nebulæ.

The great Nebulæ of Orion is the most conspicous in all the heavens. It is in the *sword*, below the middle star of the belt. R. A. 5 h., 27 m., 56 s., Dec. S. 5° 30'. It has an immense opening through which stars and systems far beyond may be seen. (See map VIII, fig. 32, of Atlas.

GEMINI. (The Twins.)

Gemini is situated on the Ecliptic between Taurus and Cancer.

Castor and Pollux, the names of the Twins, are represented by two small systems of stars, and are known by two bright stars of the first and second magnitudes named Castor and Pollux in the head of the Twins about 4° apart.

There are two stars of the second, three of the third and six of the fourth magnitude. Pollux has a periodic motion that gives a variable aspect from the first to the third magnitude, and Castor consists of two principle stars very close together, the less revolving around the larger one in 342 years and 2 months.

Apollo or
Castor
Hercules
or Pollux
Wasat
Mebusta
Tejat
Gemini
THE TWINS

VIRGO. (The Virgin.)

Virgo is the sixth sign, east of Leo in the Ecliptic. It is a large Constellation and contains many fine stars, *including* one of the first, six of the third and ten of the fourth magnitude. Its center is on the Meridian the 23rd of May.

Spica Virginis is a beautiful star, very brilliant, and with Algorab S. W. in the Crow, and Denebola N. W., and Arcturus N. E. Three very brilliant stars of similar magnitude that form a large equilateral triangle pointing to the S. Arcturus, Denebola and Cor Caroli also form the *Diamond of Virgo.*

The length of Virgo from Cor Caroli on the north to Spica Virginis on the south is 50°. Its breadth extending from Arcturus on the east to Denebola on the west is 35½°. Spica shines in solitary splendor with only one visible star near it.

The moon's distance is known by noting the exact position of Spica, thereby determining the longitude at sea, for the benefit of navigators. (As the direction of Spica's *observation* is within the Moon's path and near the earth's orbit its situation is very favorable for such purpose.) Its right ascension is 199° and it is on the Meridian the 28th of May.

The Constellation has several binary and triple stars and remarkably rich fields of Nebulæ. (See map VIII, fig. 48, Celestial Atlas.

The famous Zodiac of Dendera, as we have already noticed, commences with the sign Leo, but another Zodiac, discovered among the ruins of *Esne*, in Egypt, commences

VIRGO

THE VIRGIN

with *Virgo*, and from this circumstance, some have argued, that the regular precession of the Equinoxes established a date to this at least 2,000 years older than that at Dendera.

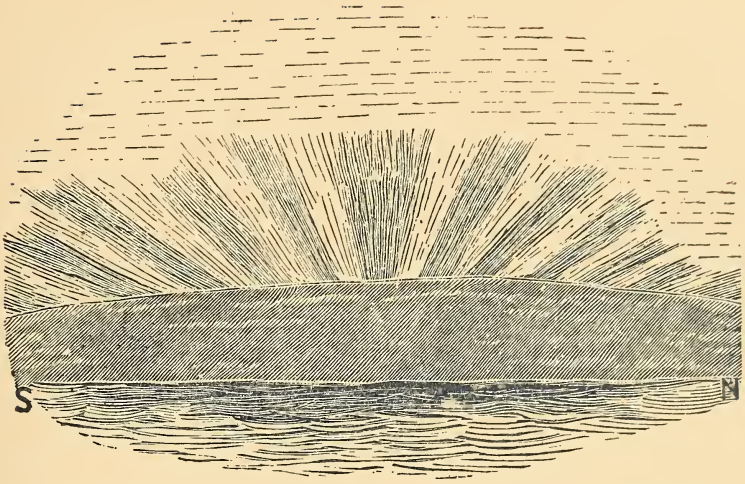
THE RED GLOW.

That space is filled with magnetic dust particles, and that they sweep over the sun, earth and other planets seems to be amply proven. During the appearance of the colored suns from 1883 to 1886 there was great solar disturbance, says Henry C. Maine. On the first of September twenty new solar spots appeared and on that date there were seven groups and ninety-five spots, one of which was visible to the naked eye. There were cyclones of great energy in the equatorial sea at the time, and a captain of a dismasted vessel was one of the first observers of the strange lights in the sky. All the colors of the Solar Spectrum appeared, but the rose and red prevailed. These lights were observed all over the United States and Europe and along the earth's equator.—*History Warner Observatory.*

The cause of these disturbances and colorations in the sun's and earth's atmospheres is owing to the presence of gaseous matter brought down from space and precipitated upon the sun and planets.

Prof. C. A. Young says in his work on the sun, page 207: The observation of the eclipse of 1871 by Lockyer and others show that hydrogen in a feebly luminous condition is found all around the sun and at a very great altitude —far above the ordinary range of prominences.

Prof. Balfour Stewart, the eminent director of the Kew observatory says: That the magnetical and meteorological processes of the earth are more pronounced when there are most sun spots.



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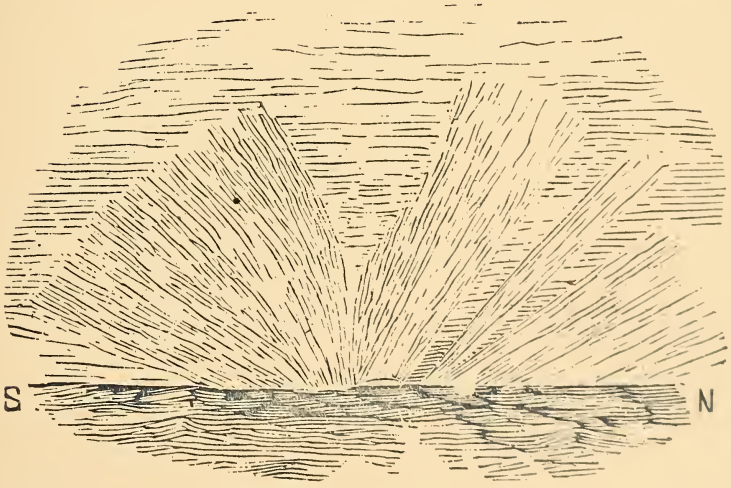

SUNSET-GLOW (Street, Som.) 1885, VI 27.

These views indicate a strong bond of sympathy between sun storms and earth storms.

MICROSCOPE, SPECTROSCOPE AND TELESCOPE.

Fig. 1 shows the structure and form of the spectroscope. An optical instrument for forming and examining spectra, particularly those produced by flames, in which different substances are volatilized, so as to determine, from the position of the spectral lines, the composition of the subtance. —*Am. Journal of Science.*

Fig. 1 represents a large instrument made for the Kew Observatory.

It has nine prisms and is used for discovering the properties of objects, both distant and near, by showing the character of the spectrum projected.

Fig. 2 represents the Spectroscope applied to the Telescope. The small tube at the lower end of the Telescope is used to collect the light, which is received at the upper end of this tube and passes through it on to the prism at the other end. This tube is called the *Collimator.*

The small Telescope at the eye of the observer is used to magnify the colors on the prisms, so they can be more readily analyzed.

Fig. 3 represents a *Microscope* of the usual structure. The Microscope is a wonderful instrument; by its powers man may discover the infinitesimal worlds below, while with the Telescope he may search for magnificent worlds above.

NOTE—Kew is one of the largest and best equipped institutions in the world for experimenting in natural science, more especially for the analysis of magneto-electric phenomena.

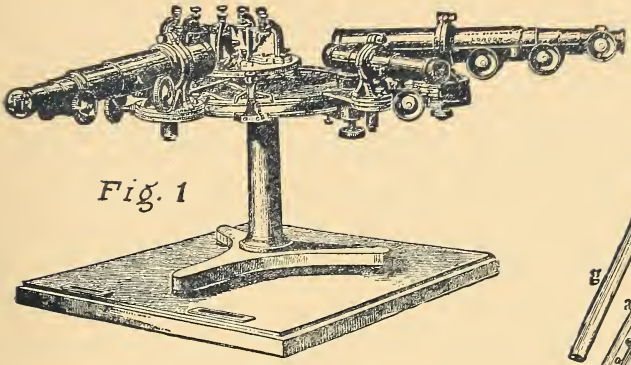

Fig. 1

Fig. 2

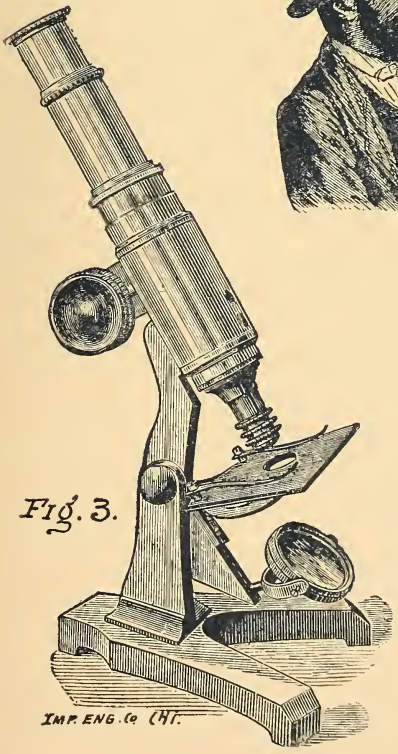

Fig. 3.

VIA LACTEA. (Milky Way.)

The star cluster known as the Milky Way is now recognized by astronomers as a complete system or universe. Dr. Herschel, after continued and thorough observation, approximately determined the shape, size and boundaries of this immense field of stars.

It appears to be a circular disk-like form, presenting at different times perpendicular, oblique and horizontal views, as shown by the plate.

Our sun with his family is located in this system, and it is supposed by some writers that he revolves around a common center, which requires a period of eighteen million years to perform one revolution.

The stars in this cluster are all suns, and the nearest one to our sun is twenty million million miles distant; and it is estimated that there are stars in this system that are five hundred times as far away.

This is only one system among many thousands brought to view, by the aid of the Telescope, which impresses the mind of the observer with the immensity of the universe.

STRUCTURE OF THE UNIVERSE.

Fig. 1, plate, represents what is supposed to be the structure of the universe. There are now discovered and catalogued about 4,000 clusters of stars like the Milky Way. Some are not as large, but they bear a general resemblance. In these star clusters all the beautiful variegated colors of the solar spectrum are represented, and there are many systems of binary, triple and other numbers of stars often observed revolving around each other. In the celestial

Fig. 5

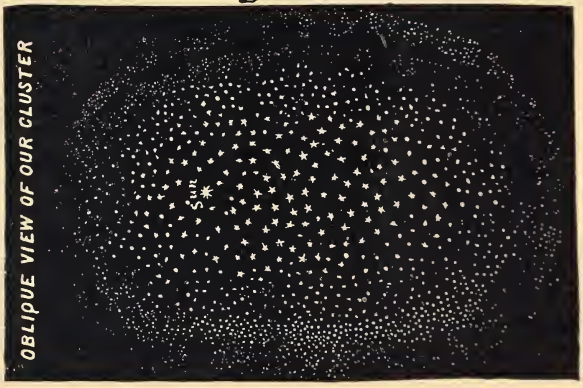

Fig. 6

Fig. 7

spaces of these clusters there are immense fields of nebulæ or starry matter with formative processes of evolutions, convolutions and gyratory motions that condense and solidify them into worlds, suns and systems. The spaces of the starry systems are also occupied by hosts of comets and meteors that sweep from one boundary to another of these immense clusters, passing over a distance of billions of miles in a single journey through the skies.

THE GREAT NEBULA IN MONOCEROS. (Unicorn.)

This interesting nebula is a *nova*, discovered some fifteen years ago, while comet seeking with the 4½ inch telescope. One very fine night, before the appearance of the red sunset phenomena, the 16-inch refractor showed it as eliptical with a center of condensation at each foci, as roughly represented in fig. 1, which was sketched for and published in the *Sidereal Messenger*.

THE SWAN OR HORSESHOE NEBULA

Proves to be a most wonderful object for study. It is in the Milky Way, a region which, though rich in star clusters, yields very few nebulæ. It is No. 4403 of General Catalogue and 17 of Messier's. Its approximate R. A. is 18 h. 14 m., Dec. — 16° 13′.

SECONDARY TAIL TO PONS–BROOKS' COMET.

This comet presented many curious freaks, but its most interesting feature was a secondary tail of peculiar shape, seen only on the evening of December 29, first, by the writer, and after, by Mr. Streeter, an astronomical friend, who was visiting the observatory.—*History, Warner Observatory.*

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GLOSSARY.

Attraction—Inherent pulling power.
Attenuated—Thin.
Annular—Ring-like.
Achievements—Feats.
Atoms—Ultimate particles.
Arcanum—Secret enclosure.
Aura—Golden light.
Astral—Star light.
Astronomy—Law of the Stars.
Approximate—Come near.
Attributes—Inborn qualities.

Cause—Formative force.
Cabalistic Record—Mysteries of traditions.
Cycles—Recurring periods of time.
Chemistry—Science of affinities.
Constellations—Figures of the stars
Crystallization—Forming a crystal.
Cosmos—Universe.
Consensus—One opinion.
Celestial—Heavenly.
Cyclones—Revolving storms.
Collimater—Collector of light.
Chronology—Science of Time.
Curriculum—A course of study.

Differential—Creating a difference.
Disk—Like a plate.
Domain—Empire.
Duplicate—Double.
Dynamics—Power.
Diapason—Musical octaves.
Disintegrate—Separate.
Dragon—Luminous exhalation.
Dicta—Sayings.
Dynasties—Race of rulers.
Duration—Continuance of time.

Endued—Inherent attribute.
Ether—Light medium.
Epilogue—Conclusion.
Energy—Inherent power.
Exploit—Heroic act.
Environment—State of existence.
Eliminate—To deduce.
Equinoctial—Equal day and night.
Equilateral—All sides equal.
Epoch—Period of time.
Enigmatical—Puzzling.
Empirical—Without reason.
Eliptical—Rounded ablong.
Elements—First principles.

Force—Active power.
Formulated—Definite forms of statement.
Firemist—Shining ether.
Fascinate—Charming influence.
Functions—Exertion of energy.

Genius—Superior natural powers.
Geology—Science of the earth.
Glories—Rays of light.
Gyratory—Spiral Motion.
Grotesque—Irregular figures.

Hieroglyphic—Sacred character.
Habitat—Abode.
Hyperbole—Figure of speech.
Hygiene—Health.
Hyades—Five stars in Taurus.
Horoscope—Aspects of natal fortune.

Introductory—Previous matter.
Interstellar—Among the stars.
Indued—Inherent force.
Inorganic—Without life.
Infinite—Without limit.
Incandescent—White heat.
Imponderable—Without weight.
Infinitesimal—Infinitely small.
Illustrated—Made clear.
Inherent—Inborn, natural.
Introspection—Looking into.

Laminated—Thin layers.

Myth—Fable.
Manifold—Many forms.
Medium—Inherent, allpervading element.
Magnetism—Polar attraction.
Magnitude Ast—Brightness of stars.
Meteorology—Science of Atmosphere.
Mathematics—Science of quantities.
Mythology—Science of myths and fables.
Molecules—Particles of matter.
Mystical—Secret rights.
Melody—Pitch of sounds.
Miraculous—Supernatural power.
Magi—Wise men.
Magic—Wisdom of the magi.
Mechanism—Mechanical action.
Malpractice—Bad practice.
Microscope—Seeing small things.
Motion—Transference of power.
Matter—Formative nature.

Nymphs—Goddesses or sea deities.
Nebulous—Cloudy.

Originate—To produce as new.
Organic—With life.
Orbit—Planets' path around the sun.
Occult—Unseen.

Obsolete—Out of use.
Observatory—Place of observation.

Parchment—Skin of animals.
Promulgate—Publish.
Preliminary—Preparatory.
Processes—Natural series of activities.
Philosophy—Search after wisdom.
Psychology—Science of the soul.
Plasm Cell substance, *life matter*.
Protoplasm—First form of life.
Precipitation Falling like rain.
Precedent Example
Phenomenon Appearance.
Physics Science of nature.
Propaganda—Proposition.
Phenomena—Plural of phenomenon
Pleiads—Seven stars in Taurus.
Platitude—Weak remark.
Potentials Endued with power.
Primordial Earliest origin.
Power—Ability inherent.

Rational—Reasonable.
Research—Seeking truth.
Repulsion Inherent pushing power.
Rhythm—Length.

Satellites—Moons, secondary worlds.
Superstition—Standing higher.
Spangles—Brilliant bodies.
Scroll—A marked roll.
Symbols—Signs of recognition.
Sphinx—Heroic monster.
Savants Wise men.
Silt—Muddy deposite.
Striated—Wavy lines.
Salutatory—Greeting.
Seismic—Shaking.
Spectra—Light shadows.
Scholarly—Like a scholar.
Spectroscope—Seeing spectra.

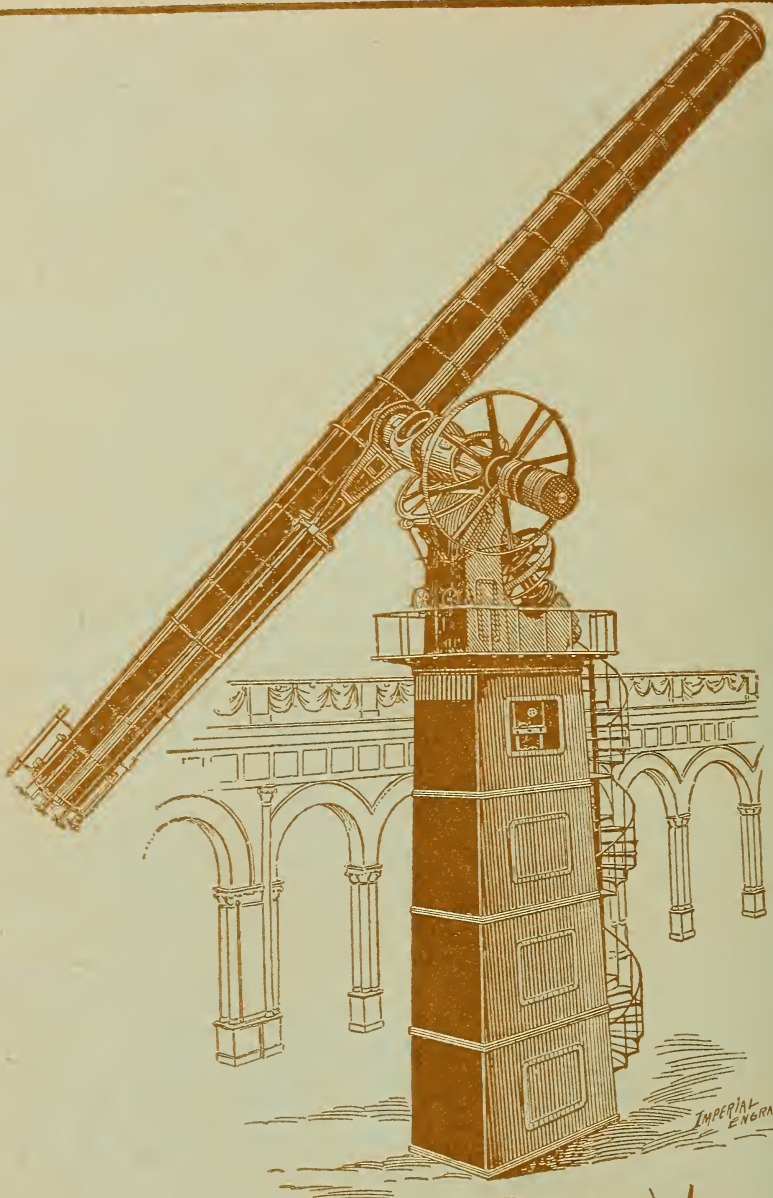
Trenchant—Severe.
Technicalities—Peculiar to art or science.
Temperature—Degree of heat or cold.
Typical—Like a type.
Thesis—Theme.
Transcend—To go beyond.
Technique—Processes of science and art.
Travesty—Disguise of Truth.
Telescope—Farseeing.

Unifying—Making one.
Universe—All creation *combined* in one
Unbiased—Free from prejudice.

Vacuum—Void space.
Viscous—Adhesive.
Void—Empty space.
Verified—Proved.
Vicissitudes—Interchange.

Weird—Magical influence.

Zodiac—Belt of Constellations.



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